King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics

## Math 131 (Term 153)

## Exam 1 (Duration: 90 minutes)

**Student Name**_____ **Student ID:** _____

| Question | Score |
|---|---|
| 1 | \13 |
| 2 | \13 |
| 3 | \13 |
| 4 | \13 |
| 5 | \13 |
| 6 | \15 |
| 7 | \20 |
| **Total Score** | **\100** |

**Exercise 1** (13 points)

A fence is to be placed around a rectangular plot so that the enclosed area is 300 m$^2$ and the length of the plot is three times the width. How many meters of fencing must be used?

**Exercise 2** (13 points)

A publishing company finds that the cost of publishing each copy of a certain magazine is 15 SR The revenue from dealers is 14 SR per copy. The advertising revenue is 10% of the revenue received from dealers for all copies sold beyond 1000. What is the least number of copies that must be sold so as to have a profit for the company?

**Exercise 3** (13 points)

The equilibrium point for a product occurs when 1000 units are produced at a price of 4 SR per unit. The producer will supply no units at 3 SR, and the consumers will demand no units at 6 SR.

**(a)** Find the supply and demand equations if they are both linear.

**(b)** Find the equilibrium point when a tax of 0.6 SR per unit is imposed on the supplier.

**(a)**

**(b)**

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**Exercise 4** (13 points)

A company has plants for producing desks on both the East Coast and West Coast. At the East Coast plant, fixed costs are 22,000 SR per year and the cost of producing each desk is 90 SR. At the West Coast plant, fixed costs are 20,000 SR per year and the cost of producing each desk is 95 SR. Next year, the company wants to produce a total of 800 desks. Determine the production order for each plant for the forthcoming year if the total cost for each plant is to be the same. Use **matrix reduction** method ONLY.

**Define your variables:**

**Augmented matrix:**

**Reduced matrix:** (Show your work on the back of this page)

**System:**

**Solution:**

**Exercise 5** (13 points)

A company manufactures three products: X, Y, and Z. Each product requires machine time and finishing time as shown in the following table:

|   | Machine Time | Finishing Time |
|---|--------------|----------------|
| X | 1 hour | 4 hours |
| Y | 2 hours | 4 hours |
| Z | 3 hours | 8 hours |

The numbers of hours of machine time and finishing time available per month are 900 and 5000, respectively. The unit profit on X, Y, and Z is 6 SR, 8 SR, and 12 SR, respectively. What is the maximum profit per month that can be obtained? Formulate the problem (**Do NOT solve it**).

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**Exercise 6** (15 points)

Use the geometric approach to maximize $Z = 15x + 30y$ subject to $\begin{cases} x \geq 10 \\ 0.2x + 0.4y \geq 8 \\ 0.5x + 0.2y \geq 8 \\ y \geq 0 \end{cases}$

**Exercise 7** (20 points)

Use the dual and simplex method to solve the following problem:

Minimize $Z = 400x_1 + 500x_2 + 1450x_3$ subject to $\begin{cases} x_1 + 2x_2 + 5x_3 \geq 36 \\ x_1 + x_2 + 3x_3 \geq 24 \\ x_1 + x_2 + 2x_3 \geq 21 \end{cases}$

**Dual Problem:**

**Final Tableau:** (Show your work on the back of this page)

**Initial Tableau:**

**Solution of the Dual Problem:**

**Solution of the Initial Problem:**